-MATH10G MATHEMATICS IN THE MODERN WORLD-

Importance of Math in the Modern World

- **Math** is essential in technology and science.
- **Math** can help in making informed financial decisions.
- **Math** is important in everyday life like cooking and home improvement projects

Mathematics is essential in the modern world, from cryptography to artificial intelligence. Explore the latest mathematical innovations

MATH IN TECHNOLOGY

Math skills and coding go hand in hand. From simple algorithms to complex machine learning models, math is essential in technology development

MATH IN BUSINESS

Math is essential for businesses to make informed decisions. Data analysis, financial planning, and risk assessment all require math skills

MATH IN EVERYDAY LIFE

Math is important in calculating budgets, managing expenses, and determining tips. Understanding percentages and fractions is essential for everyday life

CAREERS IN MATH

From data analysis to cryptography, math plays a crucial role in various industries. Explore careers in engineering, finance, tech, healthcare, and more.

The Nature of Mathematics

Mathematics is Universal A way to make sense of the world and to communicate understanding of concepts and rules using the mathematical:

1. Symbols 2. signs 3. Proofs 4. Language 5. Conversion

Natural Patterns

1.Symmetries 2. Spirals 3. Mosaic 4. stripes 5. Dots

Other People who Studied Patterns

- ✓ **Joseph Plateau** examined soap films, leading him to formulate the concept of a minimal surface.
- ✓ **Ernst Haeckel** painted hundreds of marine organisms to emphasize their symmetry.
- ✓ **D'Arcy Thompson** pioneered the study of growth patterns in both plants and animals, showing that simple equations could explain spiral growth
- ✓ **Alan Turing** predicted mechanisms of morphogenesis which give rise to patterns of spots and stripes.
- ✓ **Aristid Lindenmayer and Benoît Madelbrot** showed how the mathematics of **fractals** could create plant growth patterns.
- ✓ **W. Gary Smith** adopts eight patterns in his landscape work, namely: scattered, fractured, mosaic, naturalistic drift, serpentine, spiral, radial, and dendritic. These patterns occur in plants, animals, rocks formation, river flow, stars or in human creations.

A **fractal** is a never-ending pattern. **Fractals** are infinitely complex patterns that are self-similar across different scales. They are created by repeating a simple process over and over in an ongoing feedback loop

The Fibonacci Sequence

Leonardo Pisano Bigollo lived between **1170 and 1250** in Italy. His nickname**, "Fibonacci"** roughly means "Son of Bonacci". His father is Guglielmo Bonacci. He helped spread Hindu Arabic numerals **(0, 1, 2, 3, 4, 5, 6, 7, 8, and 9)** through Europe in place of Roman numerals which is part of the sequence, which he developed. The Fibonacci Sequence was recognized as the **Golden Ratio.**

Patterns and Regularities in the World as Organized by Mathematics

Pattern – constitutes a set of numbers or objects in which all the members are related with each other by a specific rule. It is also **known as sequence**. There can be finite or infinite number of members in a pattern.

Relation – constitutes between two sets is a collection of ordered pairs containing one object from each set. If the object x is from the first set and the object y is from the second set, then the objects

are said to be related if the ordered pair (x, y) is in the relation.

Function – is a **type of relation**. But a relation is allowed to have the object x in the first set to be related to more than one object in the second set.

Scenes in which regularities exists

Regularities is an attribute of a shape or relation; exact reflection of form on opposite sides of a dividing line or plane
Motion of Pendulum – Its period of time it takes to swing back to its original position is related to its length, but the relationship is not linear.
Reflection in the mirror plane – the image that is exactly the same size as the object and is far behind the mirror as the object is distant from the mirror.
Free Falling Object – Any object that is moving and being acted upon only be the force od gravity is said to be in a state of free fall.
Action-Reaction – In every interaction, there is a pair of forces acting on the two interacting objects.

Phenomena in the World as predicted by Mathematics

Patterns in Nature – The role of mathematics is to **describe symmetry**breaking processes in order to explain in a unified way the fact that the patterns seen in san dunes and zebra's stripes are caused by processes which, while physically different, are mathematically very similar.
Puzzles in Nature – Mathematics **solves puzzles in nature** (such as why planets move in the way that they do), describes changing quantities via calculus, modelling change (such as the evolution of the eye), and predicts and controls physical systems.

Nature and Occurrences in the as Controlled by Mathematics for Human Ends

- ***Mathematics in Medicine –***

Nurses routinely use addition, fractions, ratios and algebraic equations each workday to deliver the right amount of medication to their patients or monitor changes in their health

- In life expectancy, mathematics used to summarize the remaining years of life that that a person is expected to live.

- **Mathematics in Political Science** - Political Scientists use mathematics (**statistics**) to predict the behavior of group of people.
- **Mathematics in Economics** - Analysis and study in economics help explain the interdependent relation between different variables. Economists try to explain what causes rise in prices or unemployment or inflation.

Applications of Mathematics in the World

1. ***Mathematics in Farming and Gardening***
2. ***Mathematics in Planning a Market and Grocery Shopping.***
3. ***Mathematics Anywhere in the House***
4. ***Mathematics in Travels***
5. ***Mathematics in Construction***
6. ***Mathematics in Engineering***
7. ***Mathematics in Investment***
8. ***Mathematics in Time***

Mathematical Language and Symbols

Language is a **system of word, signs, and symbols** used by people in expressing their ideas, thoughts, and feelings. Every field has its own language and usage of words.
Mathematical language- is the system commonly used to **communicate mathematical ideas** as it is more precise than any other language.
Human languages have grammatical structures that distinguish between **nouns and verbs**. Like other languages, **mathematical language** has its own grammar, syntax, vocabulary, word order, synonyms, negations, conventions, idioms, abbreviations, sentence structure, and paragraph formation.

Using appropriate language is the key for making mathematics comprehensible and understandable especially during problem-solving and reasoning. These actions represent the process one goes thru to solve a problem:

1. **Modeling and formulating:** Creating appropriate representations and relationships to mathematize the original problem. Examples:

Urban Planning: City planners use mathematical models to simulate traffic flow, pedestrian movement, and resource allocation.
Epidemiology: Epidemiologists model the spread of diseases using differential equations.

2. **Transforming and Manipulating:** Changing the mathematical form in which a problem is originally expressed to equivalent forms that represent solutions. Example:

Optimization in Engineering Design Imagine you're an engineer tasked with designing a cylindrical storage tank to hold a certain volume of liquid while minimizing the material cost for construction.

3. **Inferring**: Applying derived results to the original problem situation and interpreting and generalizing the results in that light. **We reach conclusions based on evidence and reasoning.**

Example: **Data Collection and Analysis**: Gather data on various aspects, including the number of orders, total sales revenue, average order value, and customer demographics during the promotional period and a comparable non-promotional period

4. **Communicating:** Reporting what has been learned about a problem to a specified audience.

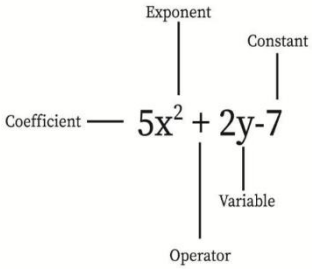
Characteristics of Mathematical Language

Mathematics is about ideas – relationships, quantities, processes, measurements, reasoning, and so on. Mathematical language differs from the language of the ordinary speech in three different ways.

1. Mathematical language is non-temporal. There is no past, present or future in mathematics.
2. Mathematical language is devoid of emotional content.
3. Mathematical language is precise

Mathematical Expressions and Sentences

Operation	Addition	Subtraction	Multiplication	Division
Symbol/s	[+]	[-]	[x, (), *]	[÷, /]
Read as	- plus - the sum of - increased by - total - added	- minus - the difference of - decreased by - subtracted from	- multiplied by - the product of - times of	- divided by - the quotient of - per



In Mathematics, there are expressions known as multivariate – a mathematical expression with three (3) or more variables as opposed to univariate (one variable) and bivariate (two variables)